Mount Diablo Astronomical Society

Diablo MoonWatch

September 2011

General Meeting

Tuesday September 27, 2011

How to Build a Planet

By Dr. Meredith Hughes

Doors open at 6:45 p.m.

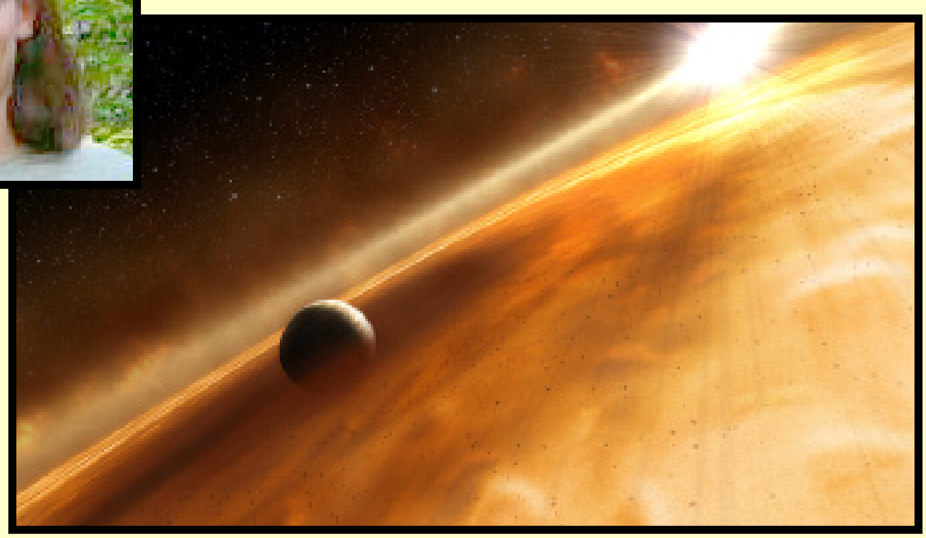
Concord Police Association Facility
5060 Avila Road, Concord

The discovery of extrasolar planetary systems has overturned entrenched ideas about how our own planetary system formed.

Around other stars we find exotic planets like nothing we see around our Sun: hot Jupiters, super-Earths, and massive planets at Kuiper Belt distances and beyond. Where do they come from, and can we devise a story of planet formation that can account for the wide diversity of systems we see around our own star and others? This talk will introduce you to some of the ways

We learn about planet formation, starting with evidence from observations with the naked eye and small telescopes and proceeding to the latest in high-resolution optical, infrared, and radio telescope observations of the disks of gas and dust around young stars. We will explore the main theories and open questions about how planets form in circumstellar disks, and attempt to place our solar system in context: are we normal?

Meredith Hughes is a postdoctoral researcher at UC Berkeley, studying planet formation primarily through short-wavelength radio observations of circumstellar disks. She holds a B.S. in physics and astronomy from Yale University and A.M. and Ph.D. degrees in astronomy from Harvard University.



She enjoys sharing her enthusiasm for science, conservation, and astronomy, and has been a volunteer interpreter with the Harvard-Smithsonian Center for Astrophysics, the Museum of Science in Boston, and the National Park Service.

What's Up

Capture Great Images Through Your Telescope!

MDAS's Imaging Group Celebrates Five Years.

by Jim Scala

continued on page 4

President's Corner

The Video-Astronomy Revolution

by Chris Ford

This month, I am going to review what promises to be a major aspect of the future of observational amateur astronomy.

Namely the use of video assisted techniques enabling one to almost instantly observe objects at a level of quality resembling conventional color astrophotography. This technology, most notably associated with the Mallincam camera and similar devices, is becoming increasingly prominent at larger star parties, delivering colorful images in only seconds rather than the hours and days it takes to capture and process high quality CCD images. The implications for astronomy outreach alone are potentially profound in that the casual public can immediately view objects that really do look like the Hubble images on the packaging of the proverbial $60 department store telescope. The dim smudge of light to the untrained eye through a conventional eyepiece can suddenly become a well defined spiral galaxy in full color - just like it is in periodicals, books, or television!


The Mallincam images in this article were captured at the GSSP 2011. (Courtesy of Chris Bernardi)

It is true that for many of us (perhaps the majority) video assisted astronomy does not compare to the emotional connection of original photons directly hitting our retinas through the traditional eyepiece. Neither does video assisted astronomy yet deliver quite the resolution and detail associated with visual observing or the best long exposure CCD images. Observing a globular cluster for that fine "sugar sprinkled on velvet" look is a unique and compelling experience that lies at the heart of our enjoyment of visual astronomy. Yet, the *experience* of using a video-astronomy camera and casually moving from one object to another to study, delivers a sense of instant gratification that is remarkably similar. In that sense video astronomy is totally unlike astrophotography with its extended processing times, and more closely resembles the visual observing experience. My own revelation was first pointing my telescope and Mallincam to the Horse Heads nebula and seeing an image that came straight out of an astronomy book.

So how do these devices work?

Let's take a look at the most popular, the Mallincam. This is essentially a conventional commercial video resolution CCD sensor modified to be electronically cooled to reduce noise suitable for low light astronomical usage. The camera can be set to exposure lengths or integrations varying between 3.3 and 110 seconds depending on the telescope. focal ratio, and subject. The resulting image is output by video to either a portable video monitor, DVD player, PC with a video card, or even to larger LCD and plasma screens. With my 130mm refractor focal reduced to F/4.7 integration times of between 7 and 28 seconds work fairly well for most deep sky objects.

It should be noted that the Mallincam is not the only product available in the marketplace, the Astrovid Stellarcam is a black and white alternative, and Orion has recently started offering cameras also. Other amateur astronomers are using off-the shelf color Samsung cameras with integration times up to about 8 seconds that cost only a couple of hundred dollars. However, the Mallincam being the first full color camera has really set the bar, and to a large degree its name has become

President's Corner: The Video-Astronomy Revolution *(Continued from the previous page)*

synonymous with video astronomy. Also price-wise, at around $1,000 a Mallincam is not that much more expensive than a 21mm Ethos eyepiece.

Being essentially photographic devices, the faster your optical system (low focal/ratio) the more quickly a high quality image is generated. There are small focal reducers that can be screwed into the Mallicam's 1.25" nose piece to improve their photographic sensitivity. I have found that a contemporary 4" or 5" apochromatic refractor at around F/6.3 with a focal reducer taking it down to around F/4.7 or less, makes an excellent and easily portable video astronomy device. In fact you do not even need a telescope, a simple F/2.8 camera lens works perfectly well if you have the right connectors. Another benefit of fast optical systems and fast integration times is that an equatorial mount for your telescope is not essential as the exposure times are too rapid for field rotation to be a factor. A standard Alt/Az mounting system works fine in most situations though tracking is desirable.

We are still at the beginning of the video astronomy era. For the future, the most obvious development path is to higher resolution CCD sensors and images. It is certainly true that current video resolution images from Mallincam's while colorful can also look grainy and pixelated compared with a visual image. Establishing an optimal viewing distance from the display device is important, otherwise stars can resemble either little square pixels or blobs as a result of the limitations of the standard NTSC video signal. At the same time, many of us now have high definition plasma television screens and

increasingly consumer priced HD video cameras for our personal use. It is only a matter of time before HD capable astronomical video cameras become available delivering a vastly superior level of image quality that will be almost photographic. Given that the integration time needed to create these HD images will still be measured in terms of seconds, the implications for observational astronomy are exciting and may well be a stimulus that will inspire a new generation of amateur astronomers.

Video astronomy is not just limited to direct viewing at your observing site.

Some amateur astronomers are now "broadcasting" their observing sessions live over the internet. This usually involves the astronomer with a headset microphone sharing an observing session with fellow "remote" observers via text, who in turn can suggest objects to look at This is also a new way to observe on cloudy nights especially from locations that you may not have easy access to. (ie: The southern hemisphere) It is also a good way to get a feel for video astronomy without investing any money up front. Other amateur astronomers are using software to do "live" stacking of the video images to register and stack each image as it comes in, to produce even higher quality imagery.

It can be expected that cooler sensors and improved signal processing will lead to more noise free images, greater signal/noise ratios, and hence faster integration times. Given that the the efficiency and sensitivity of these cameras increases the faster the opti-

President's Corner: The Video-Astronomy Revolution

(Continued from the previous page)

cal system they are attached to, video astronomy also aligns well with the current trend to larger

and faster mirrors in Dobsonian telescopes. An HD video astronomy camera matched to a relatively portable 24" to 30" F/3.0 mirror offers the prospect of amazing resolution and detail. Technically there is no reason why focal ratios as low as F/2.0 should not in future be accessible to amateurs, albeit a new generation of coma correcting optics will be required.

The only downside as far as fellow visual observers are concerned is that the screen glow of increasingly large video displays may interfere with night vision, perhaps leading to separate visual and video astronomy areas at future star parties. (Just as CCD imagers currently occupy their own areas) To this author, the potential of video astronomy is one of the most exciting and important in amateur astronomy today. One can readily envision 5 to 10 years from now a new breed of portable 30" to 40" F/2 mirrors on simple driven Alt/Az mounts with HD video cameras delivering picture book images on 60" screens to the public on Mount Diablo!

Chris Ford

What's Up

(Continued from page 1)

Have you ever wanted to take pictures through your telescope?

It's human nature to capture what we see. Imaging has never been easier, never as complex nor as rewarding. Years ago, we simply attached a film camera to the telescope, or a long focus lens and got pictures; mediocre at best. All that changed as the world went digital and excellent telescopes became available. Film has yielded to a host of imaging devices and the developing room is now a computer. And, the results are spectacular.

Five years ago a few MDAS members said, "Let's organize a special interest group devoted to astronomical imaging." We – maybe five of us – started by meeting at members houses and showing each other what we were doing. Then, Doug Grebe volunteered his classroom that's equipped with whiteboard, digital projector and we went "Big League."

We soon realized each of us has special talents and we could help each other with this fantastic hobby. Hence, our meetings have covered such diverse topics as, the theory behind imaging chips to the practicality of how to sharpen an image. One night we hooked up to a telescope in Australia via computer. You'll see the image we took.

I'll share our spectacular images, wax about our friendly fellowship and share insights into the rewards of imaging. Most important, you'll learn that it only requires very modest equipment and a willingness to try. It's easy, join the group, ask questions, laugh at your mistakes and learn as you do. We're thinking of how to include pizza at the meetings; can you help with that project?

Types of Nebulae

by Nathaniel Bates

The generally understood definition of a nebula is of a visible, thinly spread cloud of interstellar gas and dust.

However, the actual phenomenon of the nebula is a diverse reality, one that adds to the aesthetic complexity of the Universe. There are actually a number of types of nebulae, each contributing to the shimmering light show that we call the heavens.

This reflection nebula is associated with the bright star Rigel in the constellation Orion. Known as IC 2118

Each of these types of nebulae differs in what shape the nebula takes, and how it is illuminated. Studying nebulae help us to understand the birth and death cycles of stars.

First, let me discuss an elementary type of nebula, the reflection nebula. This type merely allows the light of a star to illuminate it. The light of the nebula is the scattered or reflected light of a star. An example of this type of nebula would be the Witch Head nebula, which reflects the light of the blue giant.

There is not enough ionized gas in a reflection nebula to make it more than a cloud of gas reflecting light.

A great example of an emission nebula is the Orion nebula.

A reflection nebula that is not illuminated by the light of a star is simply dark.

The second major type of nebula is the emission nebula.

This type of nebula is comprised of gas that is ionized by a nearby star. Light from the star ionizes the hydrogen gas. There is a complex process involved that emits light at various wavelengths. Each wavelength will be seen as different colors. Ionization allows us to see the emission lines within the nebula, lines that are the atomic signature of ionized hydrogen. Physicists can use these emission lines and learn about the nebula; including its red-shift in the event that they wish to study how fast it is advancing or receding from us.

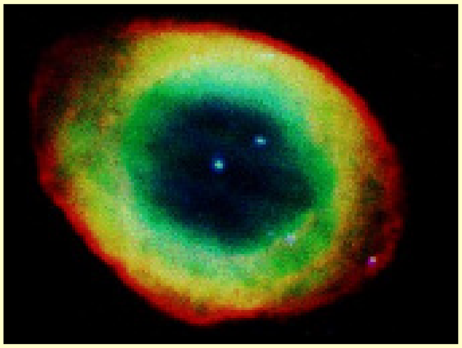
The emission process is a result of the atoms absorbing the photons, which are actually quanta of energy, causing some electrons to jump and then subsequently to descend the various energy states of atoms known as "electron shells." As they descend they will emit light of certain frequencies and display the dazzling colors we see in emission nebulae. (This is a complex quantum mechanical process, one that we will not discuss in depth at this time)

The third major type of nebular to discuss is a variant of an emission nebula, but one that forms at the end of the life cycle of a star and forms a spherical shell around that star.

The planetary nebula is the result of a star outgassing material at the end of its life.

The outgassing process occurs when ultraviolent radiation from the core of the star ionizes the outer material and ejects it in to space. Our own sun will end up as a planetary nebula with a white dwarf core after its Red Giant phase. A great example of a

Types of Nebula *(Continued from the precious page)*



The planetary nebula M57

planetary nebula is (you guessed it) the Ring Nebula:

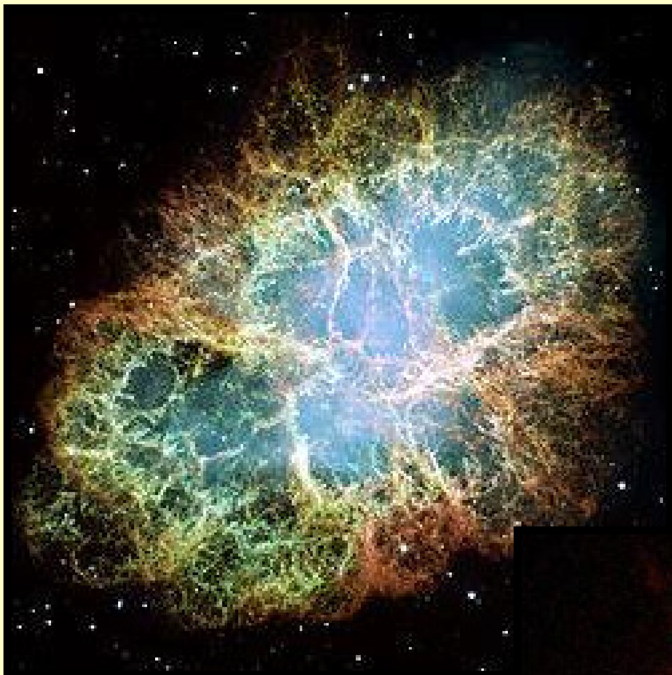
The beautiful Ring formed through the outgassing of material of a red giant. It is currently illuminated in the manner of an emission nebula by a white dwarf forming its core. The small white dwarf that illuminates such a huge volume of gas is the result of the core of a star becoming so massive that its material degenerates. Since this is a family journal, I suppose I had better explain what I mean by "degenerate." Degenerate matter is matter that does not form normal atomic structures due to the presence of intense gravity. All energy levels of its atoms are filled with electrons. Only the Pauli Exclusion Principle, which states that no two electrons of the same spin can share the same the same quantum energy level simultaneously, prevents the White Dwarf from collapsing in to a neutron star. With enough mass, about 1.4 Solar masses, gravitation will indeed collapse a White Dwarf further in to becoming a neutron star. Add yet more mass and one has a black hole from which not even light can escape.

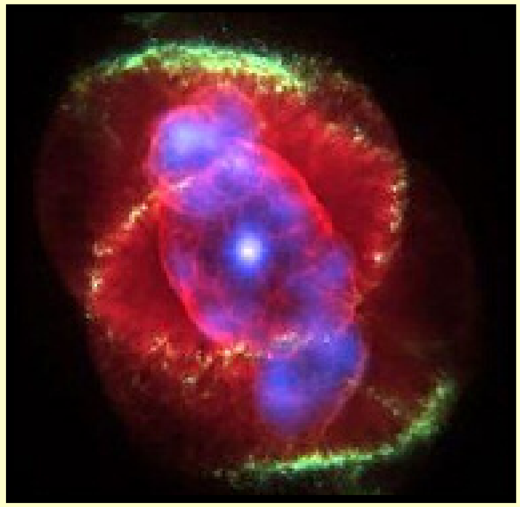
There are other types of nebulae

Such as protoplanetary nebulae which occur briefly before the planetary nebula phase, and also supernova remnants that ended the lives of massive stars, such as the repressively commanding Crab Nebula. The world of the nebula is complex and reflects a body of knowledge that one must approach humbly if one is to understand them. However, one need not be an expert on nebulae to know one thing. Astronomy would not be complete without them. For one thing, nebulae are stellar nurseries. Stars form from the wombs of nebulae when hydrogen collapses due to gravity and then undergoes fusion in order to form helium. The stars form during a process that also forms planets and other Solar System bodies. Stars ignite, shining their light to planets, at least one of which has a form of matter known as "life" that can convert star light in to complex energy. Then, at the end of the star's life, the star forms a nebula once again, perhaps a planetary nebula or else perhaps a supernova remnant that can scatter heavy materials to other star systems. In a sense, the existence of nebulae defines the beginning and endings of stars.

There is another reason why nebulae define Astronomy. Nebulae are beautiful, and what is Astronomy without beauty? I mean, this is the real reason we are out there in the freezing cold, right?

Types of Nebula *(Continued from the precious page)*





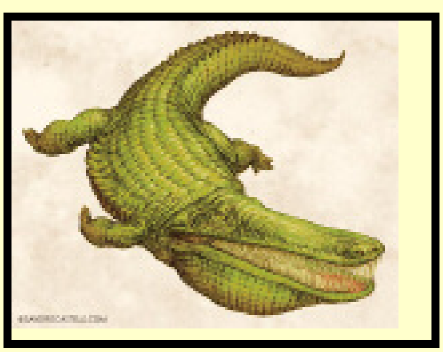
Supernova

by Dick Flasck

Long, Long Ago in a Galaxy Far, Far Away. . .

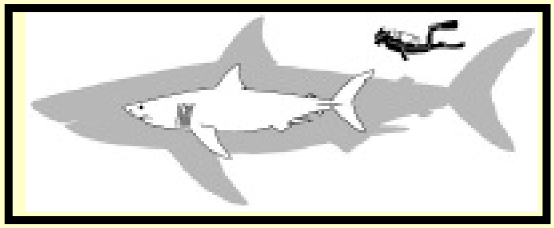
Hmm, well. . . 21 million years ago is less than 1% the age of the Earth, but for me it still qualifies as "Long Ago." In the Earth's geological time scale it was the Aquitanian age of the Miocene epoch. It was a time on Earth when the last great contiguous mega-continent, Pangaea, had already broken up into the continents we now recognize. But plate tectonics were still actively crumpling the surface of the planet, forming all the major mountain ranges (like the Himalayas). The warm tropical worldwide climate was beginning to cool off and enter a series of ice-age type thermal oscillations (so much for the Al Gore constant climate utopia).

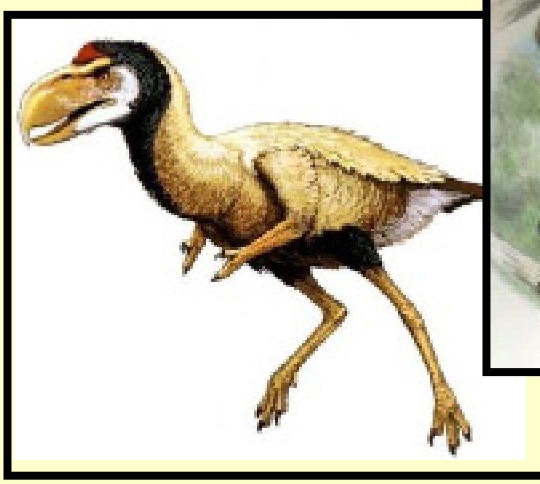
The dinosaurs had been gone for over 40 million years, but humans would not appear for another 15 million years. The Miocene was the age of mammals, but the dinosaurs had left their super-sized legacy.



There was Purussaurus, a 43 foot long, 6 ton alligator-like Miocene creature.

Ruling the seas was Megalodon, a gigantic shark of 82 feet and 50 tons. This fellow was bigger than a house and made a great white look down-right puny. It was about the same size and weight as a trucker's largest legal tractor–trailer "turnpike-double" combination (tractor pulling two full size trailers).



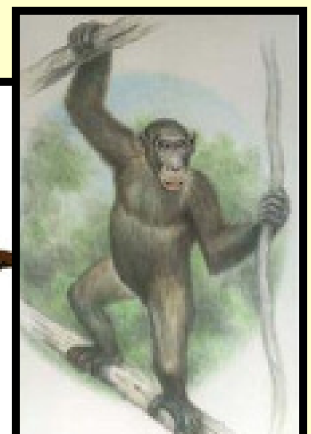


On the land there were giant "Terror Birds," like the Brontornis. With huge heads and razor sharp curved beaks for slashing flesh, they weighed in at 800 pounds and towered over most prey at 9 feet.

Daeodon, a nasty multi-ton warthog-like predator, roamed North America.

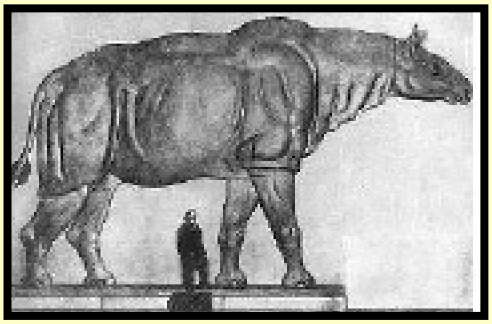
The record holder for largest land mammal ever, the Paraceratherium, a rhinoceros-like creature, was at the point of extinction. Its size of 20 tons made it comparable to a then-long-extinct medium sized Brontosaurus.

Apes were also common in the Miocene. Morotopithecus was the first ape to have a stiff spine and extended-motion joints, suggesting that he was the first ape to walk upright. So, is he my progenitor? Anyone who knows me can see the strong obvious family resemblance.



One day while these and other Miocene prehistoric animals were busy doing all the usual things Miocene prehistoric animals did, a star exploded into a type 1a supernova in a galaxy far

Supernova (Continued from the precious page)



far away. The Earth still turned and swung through its orbit; our Sun continued shining; the grass grew; all Earthly creatures continued foraging, eating, reproducing, and evolving; all oblivious to the titanic, but remote, supernova explosion.

This supernova, now known as 2011fe, in galaxy M101 was first detected on Earth on August 24, 2011 by the Palomar Transient Factory.

The light from the supernova had taken 21(+/-2) million years to travel the intervening distance between M101 and our Milky Way.

M101, The Pinwheel Galaxy in Ursa Major, is a classic face-on, grand-design spiral. It contains hundreds of billions of stars and is 170,000 light years across, making it bigger than our own Milky Way. The star that exploded was a white dwarf in a binary system that accreted too much mass from its companion. It suffered gravitational collapse, exploded and became a neutron star.

2011fe is located near the center bottom edge of this picture. It is in the outer reaches of a spiral arm, not too unlike our Sun's position in the Milky Way. If the stellar number density is similar to that of our Sun's region, the average distance between stars was about 4.5 light years. The generally accepted "safe" distance from a type 1a supernova is about 60 light years. So, statistically about 10,000 stars may have been in the fatal blast zone when 2011fe exploded 21 million years ago.

I observed 2011fe twice: on 8/27/11 when I estimated its brightness at mag 12.2, and again on 8/31/11 when my estimate was 11.0. As I sat in the quiet darkness staring at 2011fe through my telescope, I was awed by the gravity of witnessing first hand this profound event. 2011fe was not part of some Hollywood script, not Star Wars nor Star Trek. It was not fiction. It was reality unfolding in a distant corner of the universe before my very eyes. No video feed, no LCD or phosphor screen, no photo printing, no written commentary, no talking heads.

But questions raced through my mind:

Did any of the stars in the blast zone have planetary systems?

Was there life on any of the planets?

Was the life intelligent?

What was their civilization like? Their culture? Their technology?

Did they anticipate the supernova blast? Or was it a complete surprise?

Could they escape to another safe near-by planetary system? Could they somehow shield themselves? Or were they doomed to just wait for the end?

10,000 stars is a substantial, but not a vast, number. Perhaps there was no life within the blast zone; perhaps there was no tragedy in M101 twenty-one million years ago. Nevertheless, I said a silent prayer and tried to put into perspective my everyday trials, triumphs and disappointments. My best days in astronomy are like that.

Dick Flasck

Mount Diablo Astronomical Society Event Calendar—September 2011

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
28	29	30	31	1 Oregon Star Party	2 Oregon Star Party	3 Oregon Star Party 7:00 PM Astronomy: SUPERNOVA! Sunset: 7:37 PM
4 Oregon Star Party	5 Labor Day	6	7	8	9	10 Observatory Maintenance (Private) Sunset: 7:26 PM
11	12 Board Meeting (Private)	13	14	15 WCI Astronomy Night (Private)	16	17 PATS (Pasadena) Sunset: 7:15 PM
18 PATS (Pasadena)	19	20	21	22 WISE Telecon (Private)	23	24 Society Observing (Private) Sunset: 7:04 PM
25	26	27 7:15 PM GenMtg: Planet-Building	28	29 6:00 PM San Pablo Stargazing	30 Belshaw Astronomy (Private)	1

Your Help Would Be Greatly Appreciated

Our association need a few members to come at 6:30 p.m. before our monthly meeting which starts at 7:15 p.m. to help in seting up the chairs and other elements needed to conduct the general meeting.

Similarly at the end of each meeting the chairs and tables have to be removed, the room has to be cleaned and the garbages emptied.

Thank you for your help.

Board Members & Address

President
Chris Ford - cford81@comcast.net

Vice President
Rick Linden - Rick.C.Linden@gmail.com

Membership Coordinator, Mtg Room
Marni Berendsen - berendsen@aol.com

Meeting Program Chair
Dick Flasck - rflasck@aol.com

Outreach Coordinator, AANC Rep
Jim Head - jamesnhead@comcast.net

Publicity Board Member
Steve Jacobs - llasjacobs@astound.net

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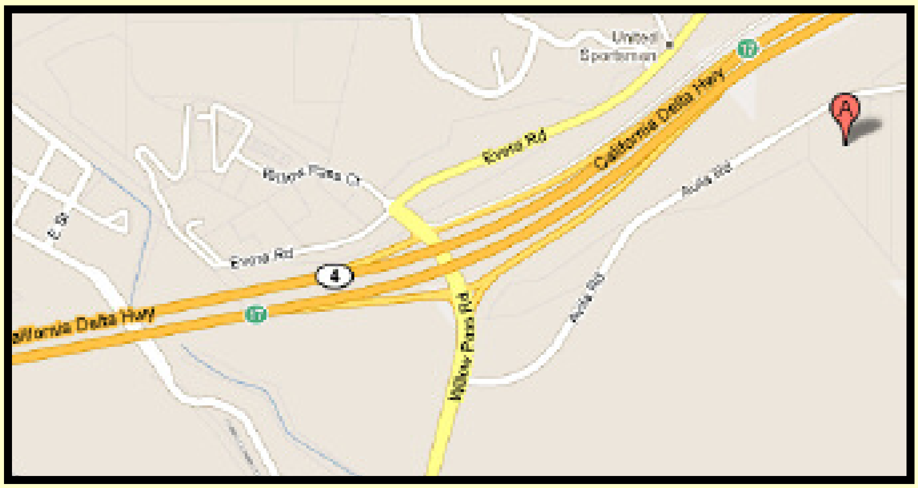
Secretary and Refreshments
Moon Trask - metallicamoon@sbcglobal.net

New Member Steward
Nick Tsakoyias - claytonjandl@aol.com

Mailing address:
MDAS
P.O. Box 4889
Walnut Creek, CA 94596-
General Meetings:
Fourth Tuesday every month,
except on the third Tuesday
Refreshments and conversations
Meetings begin at 7:15pm.
Where:
Concord Police Association
5060 Avila Road, top of the
Take Avila Road from Willow
Directions to facility:



Telescopes Needed

by Jim Head

Thursday, September 15, 2011 7:30 P.M. - 8:30 P.M.
WCI Astronomy Night, Walnut Creek Intermediate, Walnut Creek, CA Setup 6:30 PM
More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=29769

Friday September 30, 2011 from 7:30 P.M. to 8:30 P.M.
Belshaw Elementary Starry Story Night, Belshaw Elementary, Antioch, CA Setup 6:30 PM
More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=29803

Monday October 3, 2011 from 6:00 P.M. to 10:00 P.M.
Sports Basement Sidewalk Astronomy, Sports Basement, Walnut Creek, CA Setup 6 PM
More details: http://nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=29437

Wednesday October 5, 2011 from 6:30 P.M. to 8:30 P.M.
Indian Valley Stargazing Night, Indian Valley Elementary School, Walnut Creek, CA Setup 6 PM
More details: http://nightsky.jpl.nasa.gov/club/event-view.cfm?Event_ID=27379

Thursday October 6, 2011 from 6:00 P.M. to 8:00 P.M.
Pittsburg Library, Pittsburg Public Library, Pittsburg, CA Setup 5 PM
More details: http://nightsky.jpl.nasa.gov/event-view.cfm?Event_ID=29806